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Author:	Jason Barr, Associate Professors, Rutgers University
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Skyscrapers and Skylines: New York and Chicago, 1885–2007

Jason Barr

Author

Jason Barr, Associate Professor
Department of Economics
Rutgers University
Newark NJ 07102, United States
t: +1 973 353 5835
f: +1 973 353 5819
e: jmbarr@rutgers.edu
www.rutgers.edu

Jason Barr
Jason Barr is an associate professor of economics at Rutgers University, Newark, and the Director of Graduate Studies for the economics department. He received his Bachelor's degree from Cornell University in 1992, and his PhD from Columbia University in 2002. His research interests include urban and real estate economics. In particular, Dr. Barr studies the economic determinants of skyscraper height since the late 19th century. His work has appeared in prominent economics journals, such as the *Journal of Regional Science*, the *Journal of Economic History*, and *Real Estate Economics*. He is currently writing a book on the history of the Manhattan skyline.

Figure 1. Home Insurance Building, Chicago, 1885.

This paper investigates skyscraper competition between New York City and Chicago from 1885 to 2007. Skyscraper rivalry between these cities is part of US historiography, yet little work has explored the veracity of this belief. Using a newly created data set on skyscrapers, a series of statistical tests were performed to see whether there is, in fact, competitive interaction across cities. First, the results show that each city has "positively" responded to decisions in the other city, suggesting that residents in each city have a desire to build more and taller than the other. Second, height regulations for each city have periodically reduced the size of each city's skyline, and have spurred increased building activity in the other city, providing evidence that skyscraper space is substitutable across cities.

Introduction

Since the late 1880s, New York and Chicago have been two of the world's premier skyscraper cities. By 1929, New York and Chicago contained 68% of the nation's buildings of 20 stories or greater in height (Weiss 1992). Of the ten current tallest buildings in the United States, four are in Chicago and four are in New York; six would be in New York, if the Twin Towers had not been destroyed (Skyscraper Center 2013).

Ever since the telegraph and railroad created a national market in the mid-19th century, businesses and residents have had much greater mobility and locational choices. Given the ability of labor and capital to go where the returns are greatest, we would expect this to generate some competition between leading cities. If residents of one city see its rivals growing rapidly, they may feel compelled to respond.

Historically, skyscrapers have embodied two types of competition. The first is regional competition for employment and industrial growth. Economic activity must be housed somewhere; if developers don't provide the space in one location, developers in another place will. As the economy evolves, buildings age and become functionally obsolete. The needs of businesses and residents change, and, again, if one city doesn't supply these needs, then another city will. Thus, competition is about luring businesses and residents, and promoting job growth and profits.

However, because of their symbolic and aesthetic nature, skyscrapers can also be used to express psychological or sociological needs. A tall building can be a monument to local pride or a work of civic art that enhances citizens' sense of place. The skyscraper can advertise the city, as a form of "urban boosterism," drawing tourists, and placing it within the national and international conversations on cities.

Additionally, tall buildings can be used to express developers' desire to engage in conspicuous consumption (or investment) to project economic strength, and achieve a higher social status. But the need for pride-, ego- or advertising-based construction is also a competitive process, since the height and size of these projects mainly serve their purposes only relative to the height and size of other projects.

The two forms of competition can lead to two different outcomes. On the one hand, if developers in City 1 go on a building spree, it will reduce the price of building space. If developers in City 2 see a falling price, the rational response is to hold off on construction because of declining revenues from new projects. This "negative" response by builders means that skyscrapers in the two cities are "strategic substitutes": if City 2 sees that City 1

is heavily engaged in construction, builders in City 2 find that reducing construction is the most profitable response. In general, markets in which a handful of firms all produce a similar commodity will exhibit this strategic-substitutes property.

Companies, for example, are frequently moving their corporate headquarters, based on which city provides the best "bundle" of office space, employees, and access to markets and suppliers (Strauss-Kahn & Vives 2009). If these companies see an opportunity to move to a city with newer office space, they will do so.

However, if building height has non-expressly-economic purposes, such as advertising, local pride, or ego satisfaction, then relative height is an important strategic variable. If developers in one city go particularly tall, builders in the other city will respond "positively" by adding height to their buildings. In this case, building heights can be called "strategic complements," in the sense that heights in the two cities move together. Since Chicago and New York were the first skyscraper cities in the United States and were linked economically, we can look to these two cities to test these competition theories.

Figure 2. Bayard-Condict Building, New York, 1899.
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"Architects consider each city to have its own style, its own way of shaping its local environment, its own individualistic contributions to the history of architecture. Yet these contributions were not developed in isolation. There is a considerable amount of competitive interaction between architects, contractors, and developers in both cities."

With the completion of the Erie Canal in 1825, and the settling of Chicago in the 1830s, New York and Chicago became trading partners. Capital, imports, and settlers flowed west, while agricultural goods flowed east. But as the relationship developed, they also became rivals.

In 1871, Chicago's Great Fire destroyed much of the city's office space, and gave it the chance to build a modern, fireproof business district. The Home Insurance Building, completed in Chicago in 1885 (see Figure 1), was the first to incorporate an iron-skeleton structure to bear the load of the building; it paved the way for the city's early skyscraper boom. Architects, engineers, and builders who "cut their teeth" on Chicago's first generation of skyscrapers were later employed in New York as well. This interaction has lead John Zukowsky to write: "Chicago and New York – these are often thought to be the two great superpowers of American architecture. Architects consider each city to have its own style, its own way of shaping its local environment, its own individualistic contributions to the history of architecture. Yet these contributions were not developed in isolation. Throughout the 19th and 20th centuries there has been, and still is, a considerable amount of competitive interaction between architects, contractors, and developers in both cities" (Zukowski 1984:12).

Figure 3. Flatiron Building, New York, 1902.
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The list of past and present interactions is long, but here are a few important examples. In the early period, Louis Sullivan, arguably Chicago's most famous skyscraper architect, designed one of his signature buildings in New York – the Bayard-Condict Building, in 1899 (see Figure 2). Builder and skyscraper pioneer George Fuller and his firm built skyscrapers such the Monadnock (1893) and the Rookery (1888) in Chicago, and the New York Times (1904) and Flatiron (1902) building (see Figure 3) in New York, the latter of which was also designed by one of Chicago's most famous architects, Daniel Burnham.

Figure 4. Tower Building, New York, 1889.
Source: Museum of the City of New York

Competition between the two cities in this early period was keen. For example, the Chicago Daily Tribune reports a typical case of interest in 1900: "The newest thing in the racing field is the skyscraper. It involves Chicago and New York, and as usual Chicago is in the lead. A novel race of skyscrapers has been in progress for nearly a year at Cedar Street and Broadway, where two 16-story office buildings are going up on opposite corners… The American Exchange National Bank Building is being erected on the northeast corner by a New York firm of builders, and on the northwest corner Chicago contractors are putting up the St. Lawrence Building… The Chicago firm celebrated its triumph today by hanging out a sign announcing that its building will be ready for occupancy in May. The New York firm admits that it can only finish in time for the autumn renting." (Chicago Daily Tribune1900: 2).

In the 1920s, architect Raymond Hood, who resided in New York, designed both the Chicago Tribune Tower (1924) and the New York Daily News Building (1929). After World War II, German-born architect Ludwig Mies van der Rohe, head of the architecture department at Chicago's Illinois Institute of Technology, designed one of New York's most famous modernist buildings, the Seagram Building (1958). The architecture firm Skidmore, Owings, and Merrill (SOM), founded in Chicago in 1936, has designed many buildings in the two cities, including the Sears (Willis) Tower (1974) and the John Hancock Center (1969) in Chicago, and the Lever House (1952) and One World-wide Plaza (1989) in New York. Lastly, New York-based builder Donald Trump, who has built many skyscrapers in New York, in 2009 completed the 92-story Trump International Hotel and Tower (designed by SOM) in Chicago.

Over the years, however, Chicago has developed a reputation for suffering from "Second City Syndrome." That prompted Chicago newspaper reporter Don Hayner to write in 2000: "Chicago always wanted to show the world who was boss. And in case you haven't heard, it ain't New York. No matter what it achieved, Chicago saw itself as the underdog with the 'second city' syndrome. But its insecurity gave the city its power. Chicago wanted to be better than the best, but never felt like it was. So it kept challenging New York… like a kid picking a fight with the toughest punk on the corner" (Hayner 2000).

This quote suggests two things about competition. First, Chicago "positively" responds to New York's skyscraper decisions, because it feels a need to prove itself; and second, if New York also responds "positively" to Chicago, then Chicago is more aggressive than New York.

Height Policies

Over the years, city governments have created policies that either directly or indirectly regulate building height. If competition exists across cities, it's important to consider how these policies might have affected that competition.

New York's first "skyscraper," the Tower Building (11 floors), was completed in 1889 (see Figure 4), about four years after Chicago's first. With the use of steel-skeletal construction and elevators, the engineering limits to height were essentially eliminated (Peet 2011). The initial reaction of New York's government was to do nothing. The first generation of skyscrapers were not subject to any height or bulk regulations, and developers felt free to build tall buildings that maximized the total rentable space by using as much of the plot area as possible.

Partly as a result of skyscrapers' emergence, New York City implemented comprehensive zoning rules in 1916 that created height and use regulations for all lots in the city. The 1916 code created setback requirements; buildings had to be set back from the street based on some given multiple of the street width. The multiples ranged from 1.0 to 2.5. For a particularly wide street of 30.5 meters, in a 2.5 multiple zone, the curtain wall of the building could rise 76 meters before it had to be set back. A tower of any height could be built, as long as its area was not more than 25% of the lot area. This law promoted the "wedding-cake" style of architecture, most famously embodied by the Empire State and Chrysler buildings. By regulating the shape of buildings, sunlight blockage would be reduced, and height "arms races," where developers built taller solely to access sunlight that was being blocked by surrounding towers, could be prevented.

In 1961, New York City implemented an updated zoning law. The new code put limits on the total building volume by fixing the floor area ratios (FARs) in different districts. The FAR

Year	Chicago	New York
1893	39.6 meters limit	
1902	79.2 meters limit	
1911	61.0 meters limit	
1916		Setback multiple
1920	79.2 meters limit on podium + 121.9 meters for tower = 201.1 meters	
1923	80.5 meters podium + 121.9 meters tower = 202.4 meters, with area & volume limits	
1942	Volume capped at 44 meters x lot size (FAR ≈ 12)	
1957	FAR limits + bonus	
1961		FAR limits + bonus

Table 1. Height regulations in New York and Chicago

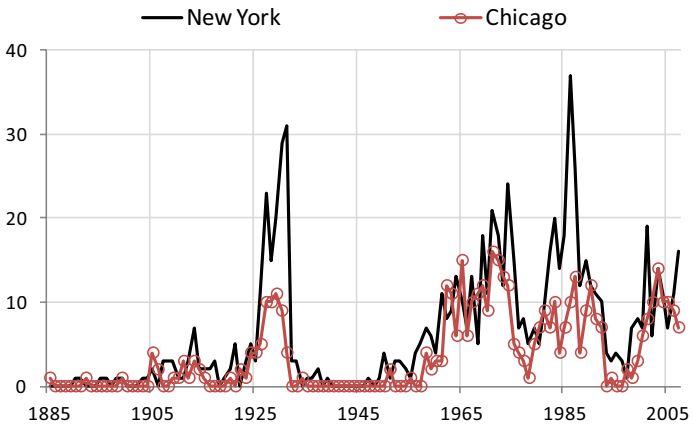

Figure 5. Number of skyscraper completions in New York and Chicago, 1885–2007

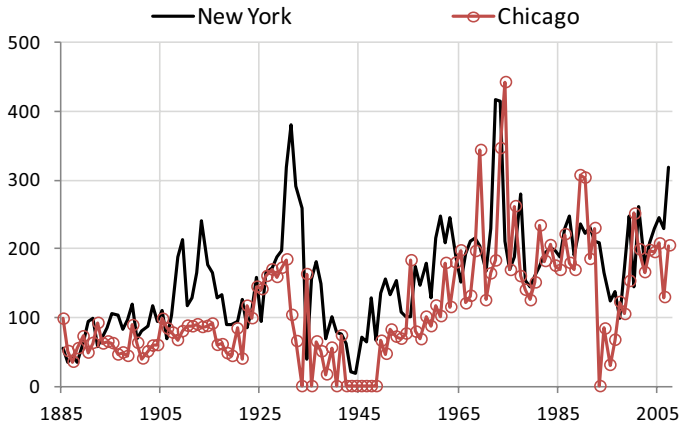

Figure 6. Height of the tallest completed building (meters) in each city, 1885–2007

gives a building's total allowable floor area as a ratio of the lot size. For example, a FAR of 10 means that total floor area can be ten times the lot area. Thus, a builder could construct a 10-story building that covers the entire lot, or a 20-story building that covers half the lot. The maximum FAR was set at 15, but there are various ways to get FAR bonuses to increase height or bulk.

Chicago, however, unlike New York, put direct limits on building heights between 1893 and 1923. Table 1 summarizes the building-height regulations in New York and Chicago. In 1893, Chicago imposed a 39.6-meter cap. In 1902, the height limit was doubled to 79.2 meters; but only nine years later in 1911, the maximum height was reduced to 61.0 meters.

In 1920, a new approach was taken. The height limit for occupiable spaces was raised again to 79.2 meters, but the law allowed for the construction of towers that could rise to 122 meters, though they could not be occupied, and were to be used only as ornaments. The fact that such uninhabitable towers were allowed in Chicago strongly suggests a demand for buildings that could be used for advertising or strategic purposes.

In 1923, the Chicago height limit was raised to 80.5 meters, and habitable towers were also permitted, if the area of the tower was less than 25% of the plot area and less than one-sixth of the volume of the main building. These rules were in effect until 1942. In that year, a more flexible approach to height was implemented based on a consideration of volume, rather than floor area alone. For much of downtown Chicago, the maximum building volume was capped at the area of the plot times 44 meters.

Finally, starting in 1957, the current approach was implemented. Builders were given FAR caps. In downtown Chicago, builders had a FAR of 16; FAR bonuses were given if builders provided plaza space around the building (Schwieterman et al. 2006: Chapter 9). As in New York, these regulations promoted the boxy towers that are common today.

Shultz and Simmons argue that height limitations in Chicago were helpful to New York. They write that during the fixed-height limitations period, "New York could and did build office buildings to house the great expansion of business. Some of this business wanted to come to Chicago, and would have, if it could have been accommodated there" (Shultz & Simmons 1959: 286–287).

Testing for Competition

Despite the widespread belief that skyscraper height is a strategic "weapon," there has been no systematic, statistical study testing the veracity of this claim. While the popular media tends to focus on the tallest of the tall and the record-breaking buildings, a larger data set is needed to perform a series of statistical tests to investigate the competition hypotheses.

To this end, a data set was created for skyscrapers in New York and Chicago from 1885 to 2007, focusing on two measures related to building height. The first variable, the number of tall buildings completed each year in each city, is a measure of developer competition in general. For example, if developers see construction in one city, they might decide to marginally increase the size of their buildings, thus carrying them over the skyscraper "threshold."

To simplify the analysis, in this study, a fixed cutoff was used to determine whether a building is a "skyscraper" or not. For Chicago, a "skyscraper" is a building that is 80 meters or taller; while for New York, the threshold is at least 90 meters. The 80-meter threshold was chosen for Chicago because of its history of limiting height; reducing the threshold increases the number of years with at least one 80-meter or taller building (though using a 90-meter threshold does not materially affect the conclusions). Buildings of these heights were commonly built after 1885.

The second variable examined is the tallest building completed in each city in each year since 1885. This variable is used to observe how building height "responds" across the two cities. In this study, no attempt was made to distinguish the underlying uses of the building themselves; the data set contains offices, residential, and all other types of occupied buildings. This is done, again, to simplify the analysis.

Figure 5 shows the annual number of completions, and Figure 6 shows the height of the tallest building constructed in each city from 1885 to 2007. The graphs demonstrate a few interesting facts. First, based on Figure 5, tall-building construction happens in long waves of about 25 years in duration, on

average. Second, the cycles of each city tend to be in sync, with their peaks and troughs roughly corresponding. New York's peaks, however, have tended to be higher. The 1931 peak reflects the building boom of the Roaring Twenties; the peak in the mid-1980s was due, in part, to government policies that encouraged construction.

In regard to building heights, Figure 6 shows that New York consistently built taller, until the mid-1960s, when average height in the two cities became comparable. While there is no way to directly conclude anything about height competition from the graphs, the fact that the two cities have such similar cycles suggests that competitions cannot be ruled out. If the peaks and troughs across the two cities were unrelated, it would likely indicate very few linkages.

In order to test for competition, it's necessary to first to account for the factors that drive height within a city, separate from any inter-city interactions. The building patterns seen above may simply reflect the ebb and flow of economic activity within each city and the nation as a whole, more so than direct competition between two cities.

Because specific data on actual incomes and costs are not publicly available for the vast majority of projects, national or city-wide variables were used to help explain construction patterns. To account for the demand for building space, the data set contains the annual growth rate of the national gross domestic product (GDP), the fraction of workers employed in the Finance, Insurance and Real Estate Industries (FIRE), the growth in the Standard and Poor's 500 Index, and each city's regional population. These variables are likely to be positively related to skyscraper construction.

Measures of the plot sizes for the underlying buildings were also included, because presumably large plot sizes are more favorable for constructing tall buildings, since they help limit the constraints imposed by elevators. Taller buildings require more elevator shafts, which eats into rentable space. A larger plot allows builders to add the extra elevators needed to reap returns from having more floors.

To account for the costs of construction, an index of national building-materials costs was included; this is likely to be negatively related to skyscraper height. To measure the cost of and access to financing, data on real interest rates, and the growth rate of commercial real estate loans nationwide were also collected. Higher interest rates or lower loan availability is likely to reduce construction, all else equal. Finally, the total number of skyscrapers already completed in each city was also included as a measure of the supply of space; one would expect a negative relationship between the total amount already built and future construction, since a greater supply would reduce the price of space.

The third set of variables relate to government policies on height. To this end, a set of "dummy" (1/0) variables were created for the years in which each type of regulation was in place. These variables measure the average impact of these policies on height across the 20th century. For example, for New York City, a "1916 Zoning Variable" took on the value of one for the years 1916 to 1960; and zero for other years, to determine how building height was impacted during those years, controlling for the other variables that determine skyscraper construction patterns.

After the data collection, the next step was to perform a regression analysis. This statistical procedure shows how the above-listed variables are correlated (and are presumably causal) with building completion counts and heights. The results show that these variables can largely account for the changes in building activity from year to year. In other words, the results show that number of tall buildings and their heights are first and foremost a rational response to the economic climate of each city – when demand for space is high, so are building heights; when costs go up, heights go down, etc.

#	Pseudo-Equation
1	NY Completions = Economic Variables (two years prior) + Chicago Completions (year prior)
2	Chi. Completions = Economic Variables (two years prior) + NYC Completions (year prior)
3	NY Height = Economic Variables (two years prior) + Chicago Height (year prior)
4	Chi. Height = Economic Variables (two years prior) + NY Height (year prior)

Table 2. Pseudo-equations for testing for competition.

In order to test for competition, the next step, after accounting for the supply and demand variables, was to see how construction decisions in one city affect the other. We asked, "Do building decisions in one city determine decisions in other, after controlling for the economic factors that drive skyscraper height?"

To this end, for each of the four variables of interest (the number of completions and the height of the tallest building in each city), the other city's decision in the prior year is included as a control variable. Table 2 gives the pseudo-equations that are estimated by using regression analysis. The goal was to perform a series of statistical tests to see if the other city's building decisions should be included on the right-hand side of the table, and if so, whether the effect was positive or negative.

The results show positive and statistically significant relationships in all four cases. The statistical tests support the strategic complements theory; namely, each city has positively responded to building patterns in the other city. For both cities, the estimated response from the other city is relatively small. For example, if one city doubled the number of skyscrapers completed from one year to the next, for example, from 10 to 20, the other city would increase skyscraper completions by about 20 to 25% (two to three more buildings), on average.

For the height of the tallest building, the results show that New York adds an average of 1.2 meters to its height whenever there is a 10-meter increase in Chicago's height in the prior year, all else equal. Chicago's response is

greater; with every 10 meters added in New York, Chicago responds by adding about 2.6 meters, one year later.

The results, however, do not show convincing evidence that Chicago suffers from a "Second City Syndrome." In terms of skyscrapers completed, New York's response to Chicago's construction is slightly larger. In terms of the height of the tallest building, while Chicago's height appears more responsive than New York's, it is not so much larger to safely conclude that Chicago acted out of a sense of inferiority.

The Effects of Height Regulations

The fact that each city has had different height regulations means that statistical tests can be performed to see how these regulations have impacted not only their own city's skyline, but that of their rival as well. Shultz and Simmons argue that Chicago's height caps were a boon to New York. If this is the case, it would provide evidence for the strategic substitutes theory. Those businesses and residents "priced out" of Chicago due to low building supply would move to New York. This would increase demand in New York, and a few years later, more and/or taller skyscrapers would be completed.

To investigate the effects of height regulations, two tests were performed. First, each city's own "yes/no" zoning variables were included in the regression equation for each period they were in effect to see if these height restrictions were, in fact, "binding," (i.e., a real constraint to developers). Second, the "yes/no" zoning variables from the other city (from four years prior) were included in the regression equation.

The statistical results show that, on average, height regulations did, in fact, bind developers in their own cities. Note, however, that these conclusions say nothing about whether height regulations are "good" or "bad" for the quality of life in each city. Height regulations were generally designed to reduce shadows, excess congestion, or fire risk; but they did so at the expense of limiting supply.

Lastly, the results show that height restrictions in one city, were, in fact, met with increased building activity in the other city, supporting the theory that skyscraper space is substitutable across the two cities. For example, during the height-restrictions period in Chicago, the regression results suggest that, on average, New York doubled the number of completions during that time, and added about 60 meters to the heights of the tallest buildings, controlling for the other determinants of building height.

Conclusion

Chicago and New York are the two most important skyscraper cities in the United States. Their rapid growth in the late-19th and early-20th centuries drove them to construct tall buildings to house their businesses and residents. But cities don't grow in isolation; their well-being depends on what other cities do. This interaction can lead to skyscraper competition, both to house economic activity and to out-do rivals. Using a newly-created data set, a series of statistical tests were performed, and they confirm competitive interaction between New York and Chicago. The results show that each city added to its skyline as a response to the other city. Further, the evidence indicates that height regulations in each city provided opportunities to the other city as well. What will the future bring? Perhaps American cities will be drawn into competition with their newly-emerging Asian rivals, which are arguably already competing with each other and globally. ■

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